Best Medical International, Inc. v. Varian Medical Systems, Inc., et al.
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Varian's Invalidity Contentions – Exhibit A-1

Claim Chart Against U.S. Patent No. 6,038,283 ("'283 patent")

Charted Reference: Mark P. Carol, *Integrated 3-D Conformal Multivane Intensity Modulation Delivery System for Radiotherapy*, Proceedings of the XIth Int. Conference on the Use of Conformal Therapy on Mar. 20-24th, 172 (Mar. 1994) ("**Carol 1994 Art. 1**")

Carol 1994 Art. 1 qualifies as prior art to the '283 patent under at least 35 U.S.C. §§ 102(a) and/or 102(b).[1]

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Claim Element	**Evidence of Invalidity**
[not asserted] 1. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "A linear accelerator-based three-dimensional conformal radiation therapy planning and treatment system has been developed with particular applications in the fields of conformal radiation therapy, radiosurgery and stereotactic radiation therapy. Called Peacock, it is an approach to intensity modulation radiation therapy which is in several respects the mirror image of computed tomography (CT)." Carol 1994 Art. 1 at 172. "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

[1] The excerpts cited herein are exemplary. For any claim limitation, Defendant may rely on excerpts cited for any other limitation and/or additional excerpts not set forth fully herein to the extent necessary to provide a more comprehensive explanation for a reference's disclosure of a limitation. Where an excerpt refers to or discusses a figure or figure items, that figure and any additional descriptions of that figure should be understood to be incorporated by reference as if set forth fully therein.

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[a] using a computer to computationally obtain a proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "A linear accelerator-based three-dimensional conformal radiation therapy planning and treatment system has been developed with particular applications in the fields of conformal radiation therapy, radiosurgery and stereotactic radiation therapy. Called Peacock, it is an approach to intensity modulation radiation therapy which is in several respects the mirror image of computed tomography (CT)." Carol 1994 Art. 1 at 172. "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] using a computer to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172.

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	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] incorporating a cost function at each iteration to approach correspondence of a CDVH associated with the proposed radiation beam arrangement to a CDVH associated with a predetermined desired dose prescription; and	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired prescription and accepting the change of the	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172.

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proposed beam arrangement leads to a greater correspondence to the desired dose prescription to obtain an optimized radiation beam arrangement.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 2. [pre] The method of claim 1 wherein the cost function is obtained by the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 1. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] determining a CDVH associated with the desired dose prescription;	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] assigning zones to each CDVH;	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] assigning weights to each zone, applicable to the CDVHs associated	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment

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with both the desired dose prescription and the proposed radiation beam arrangement;	planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] calculating a zone cost for each target and each structure, according to the following formula: $C_z = W_z * (A_p/A_d)$, where C_z is the cost for the current zone, W_z is the weight assigned to the current zone, A_p is the area or length of the current zone of the proposed CDVH, and where A_d is the area or length of the current zone of the desired CDVH;	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[e] calculating a target or structure cost for each target or structure, according to the following formula: $C_T = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$, and $C_S = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$, where C_S and C_T are the cost for each structure or zone, and C_{z1}, C_{z2}, C_{z3}, and C_{zn}, are the costs calculated for each zone of the first, second, and third, through the nth zone of each target or structure; and	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[f] calculating a total cost for the change in the proposed radiation beam arrangement,	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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according to the following formula: $C_{Total} = C_S + C_T$, where C_{Total} is the total cost of the proposed change to the radiation beam arrangement.	
[not asserted] 5. The method of claim 2, wherein the proposed radiation beam arrangement is calculated using simulated annealing radiation therapy planning methods.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
6. The method of claim 1, further comprising the step of applying the optimized radiation	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "A linear accelerator-based three-dimensional conformal radiation therapy planning and treatment system has been developed with particular applications in the fields of conformal radiation therapy, radiosurgery and stereotactic

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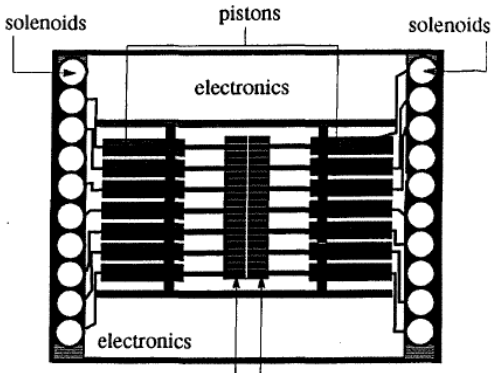
beam arrangement to the patient with a conformal radiation therapy apparatus.	radiation therapy. Called Peacock, it is an approach to intensity modulation radiation therapy which is in several respects the mirror image of computed tomography (CT)." Carol 1994 Art. 1 at 172. "This nonuniform exposure is created by an electro-mechanical device, called MIMiC, which attaches to the wedge tray slot on the treatment machine. The MIMiC functionally narrows the beam coming from the accelerator down into two thin 'slices,' further dividing these 'slices' into 40 'smaller' beams, 20 for each slice (Figure 2). Each beam is defined by an 8 cm tall tungsten vane; each vane is powered by a miniature pneumatic piston controlled by a solenoid valve. Turning the valve on causes air to flow to the front side of the piston, which drives the vane out of the field. When the valve is turned off, constant air pressure applied to the backside of the piston drives the vane back into the field (60 – 80 millisecond movement in either direction). Each vane has an associated set of sensors which track absolute amount of movement as well as speed of movement in/out of the field." Carol 1994 Art. 1 at 172.  Figure 2: Diagram of MIMiC "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one." Carol 1994 Art. 1 at 172. "Preliminary studies have shown a quantitative ability of the MIMiC to deliver the dose distributions predicted by Peacock Plan (Figures 3 and 4)." Carol 1994 Art. 1 at 173.

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	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
7. The method of claim 2, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 6. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
9. The method of claim 5, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 6 and 7. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
10. The method of claim 1, wherein the CDVH associated with the pre-determined desired dose prescription is	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose prescription entered into the computer.	
12. The method of claim 2, wherein the CDVH associated with the pre-determined desired dose prescription is computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 10. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
22. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to a tumor target volume	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 1[pre].

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while minimizing radiation of a structure volume in a patient, comprising the steps of:	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using a computer to computationally obtain a proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 1[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] using a computer to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] incorporating a cost function at each iteration to approach correspondence of partial volume data associated with the proposed radiation beam arrangement to	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 1[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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partial volume data associated with a pre-determined desired does prescription,	
[b2] wherein the proposed radiation beam arrangement is changed by changing the beam weights; and	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* "The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired prescription and accepting the	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 1[d]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a greater correspondence to the desired prescription to obtain an optimized radiation beam arrangement.	
23. The method of claim 22, wherein the partial volume data is entered directly in the computer.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
24. The method of claim 22, wherein the partial volume data is calculated by the computer based on CDVH graphically entered into the computer using a pointing device.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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25. [pre] An apparatus for determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising:	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[pre] and 22[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] a computer, adapted to computationally obtain a proposed radiation beam arrangement,	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[a] and 22[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] the computer further adapted to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[b] and 22[b1]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b2] wherein the proposed radiation beam arrangement is	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 22[b2].

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changed by changing the beam weights,	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] the computer further adapted to incorporate a cost function at each iteration to approach correspondence of partial volume data associated with the proposed radiation beam arrangement to partial volume data associated with a pre-determined desired dose prescription, and	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[c] and 22[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] the computer further adapted to reject the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[d] and 22[d]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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desired dose prescription and to accept the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a greater correspondence to the desired does prescription to obtain an optimized radiation beam arrangement.	
26. The apparatus of claim 25, wherein the partial volume data is represented as a CDVH.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
27. The apparatus of claim 25, further comprising: a conformal radiation therapy apparatus in communication with the computer for applying the optimized radiation	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 6, 7 and 9. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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beam arrangement to the patient.	
28. The apparatus of claim 27, wherein the partial volume data is represented as a CDVH.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 26. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 33. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to at least one tumor target volume while minimizing radiation to at least one structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[pre], 22[pre], and 25[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] distinguishing each of the at least one tumor target volume and each of the at least one	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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structure volume by target or structure type, wherein the target or structure types are distinguished as either Biologically Uniform or Biologically Polymorphic;	
[b] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 23. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] entering the desired partial volume data into a computer;	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 23. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] in response to the desired partial volume data and in response	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:*

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to the target or structure type of each of the at least one tumor target volume and each of the at least one structure volume, using the computer to computationally calculate an optimized radiation beam arrangement.	"The 3-D planning and viewing program (Peacock Plan) which creates the beam weights delivered by the MIMiC is an 'automated' one. Rather than verifying a user-designed program, as is the norm in conventional treatment planning, the system plays an active role in creating the plan. Peacock starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. Considered an 'inverse approach', an iterative process is used to determine a set of beam weights which, when projected into the treatment space, will deliver not only the prescribed dose to the identified target volume but also will keep the dose to avoidance and sensitive volumes below user-defined limits." Carol 1994 Art. 1 at 172. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
34. The method of claim 33, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 6, 7, 9, and 27. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 40. [pre] A method of determining an optimized radiation beam arrangement for applying radiation for at least one tumor	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[pre], 22[pre], 25[pre], 33[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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target volume while minimizing radiation of at least one structure volume in a patient, comprising the steps of:	
[a] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 33[b]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] entering the desired partial volume data into a computer;	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 23 and 33[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] in response to the desired partial volume data, using the computer to computationally approximate desired	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[c], 22[c], and 25[c].

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CDVHs for each of the at least one target and structure associated with the desired dose prescription; and	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] using the computer to computationally calculate the optimized radiation beam arrangement associated with the CDVHs approximated by the computer.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 1[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
42. The method of claim 40, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 6, 7, 9, 27, and 34. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 44. [pre] The method of claim 40, wherein the	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claim 40.

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CDVHs approximated by the computer are approximated by the steps of:	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using the computer to computationally obtain a set of proposed beam weights;	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[a], 22[a], and 25[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] using the computer to computationally change the set of proposed beam weights iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 1[b], 22[b1], and 25[b1]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b2] incorporating a cost function at each iteration to determine a cost of the change to the set of proposed beam weights; and	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] rejecting the change to the set of	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:*

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proposed beam weights if the change to the set of proposed beam weights leads to a lesser correspondence to the desired CDVHs and accepting the change to the set of proposed beam weights if the change to the set of proposed beam weights leads to a greater correspondence to the desired CDVHs.	*See* claims 1[c], 22[c], and 25[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
46. The method of claim 44, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 1. For example:* *See* claims 6, 7, 9, 27, 34, and 42. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 1, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Chart Against U.S. Patent No. 6,038,283 ("'283 patent")

Charted Reference: Mark P. Carol, et al., *An Automatic 3-D Conformal Treatment Planning System for Linear Accelerator Based Beam Modulation Radiotherapy*, Proceedings of the XIth Int. Conference on the Use of Conformal Therapy on Mar. 20-24th, 108 (Mar. 1994) ("**Carol 1994 Art. 2**")

Carol 1994 Art. 2 qualifies as prior art to the '283 patent under at least 35 U.S.C. §§ 102(a) and/or 102(b).[1]

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[not asserted] 1. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Unlike this experience-based, trial-and-error approach to treatment planning, Peacock Plan starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. The approach and algorithms are similar to the ones used in computer tomography, the treatment beams are weighted so that when they are projected into the treatment space, they superimpose to give the desired dose prescription. These weightings can be generated through a variety of iterative and algebraic processes. Peacock uses a form of simulated annealing to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but also will keep the dose to other patient volumes below user-defined limits. At each iteration of the simulated annealing process, the weight of a single randomly-chosen beam is changed by a small amount and the resulting effect and 'cost' are calculated. If the resulting cost is lower than the cost from the previous iteration, the change in the beam is accepted. If the resulting cost is higher than the cost from the previous iteration, then the change may not be accepted. After a large number of iterations, a set of beam weights is arrived at which produces the desired result as guided by the restraints placed on the system." Carol 1994 Art. 2 at 108.

[1] The excerpts cited herein are exemplary. For any claim limitation, Defendant may rely on excerpts cited for any other limitation and/or additional excerpts not set forth fully herein to the extent necessary to provide a more comprehensive explanation for a reference's disclosure of a limitation. Where an excerpt refers to or discusses a figure or figure items, that figure and any additional descriptions of that figure should be understood to be incorporated by reference as if set forth fully therein.

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	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using a computer to computationally obtain a proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Unlike this experience-based, trial-and-error approach to treatment planning, Peacock Plan starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. The approach and algorithms are similar to the ones used in computer tomography, the treatment beams are weighted so that when they are projected into the treatment space, they superimpose to give the desired dose prescription. These weightings can be generated through a variety of iterative and algebraic processes. Peacock uses a form of simulated annealing to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but also will keep the dose to other patient volumes below user-defined limits. At each iteration of the simulated annealing process, the weight of a single randomly-chosen beam is changed by a small amount and the resulting effect and 'cost' are calculated. If the resulting cost is lower than the cost from the previous iteration, the change in the beam is accepted. If the resulting cost is higher than the cost from the previous iteration, then the change may not be accepted. After a large number of iterations, a set of beam weights is arrived at which produces the desired result as guided by the restraints placed on the system." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] using a computer to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Unlike this experience-based, trial-and-error approach to treatment planning, Peacock Plan starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution. The approach and algorithms are similar to the ones used in computer tomography, the treatment beams are weighted so that when they are projected into the treatment space, they superimpose to give the desired dose prescription.

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	These weightings can be generated through a variety of iterative and algebraic processes. Peacock uses a form of simulated annealing to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but also will keep the dose to other patient volumes below user-defined limits. At each iteration of the simulated annealing process, the weight of a single randomly-chosen beam is changed by a small amount and the resulting effect and 'cost' are calculated. If the resulting cost is lower than the cost from the previous iteration, the change in the beam is accepted. If the resulting cost is higher than the cost from the previous iteration, then the change may not be accepted. After a large number of iterations, a set of beam weights is arrived at which produces the desired result as guided by the restraints placed on the system." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] incorporating a cost function at each iteration to approach correspondence of a CDVH associated with the proposed radiation beam arrangement to a CDVH associated with a predetermined desired dose prescription; and	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "These weightings can be generated through a variety of iterative and algebraic processes. Peacock uses a form of simulated annealing to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but also will keep the dose to other patient volumes below user-defined limits. At each iteration of the simulated annealing process, the weight of a single randomly-chosen beam is changed by a small amount and the resulting effect and 'cost' are calculated. If the resulting cost is lower than the cost from the previous iteration, the change in the beam is accepted. If the resulting cost is higher than the cost from the previous iteration, then the change may not be accepted. After a large number of iterations, a set of beam weights is arrived at which produces the desired result as guided by the restraints placed on the system." Carol 1994 Art. 2 at 108. "Optimisation of beam transmittance is performed by applying the simulated annealing algorithm based upon a cost function. Cost is the sum of weighted costs for each structure and target (the weights being specified by the user during prescription). For targets, cost is the mean-squared difference between realised dose and prescribed dose. For radiation-sensitive structures, cost is the mean-squared difference between realised dose and zero dose. The algorithm attempts to minimise the cost over the iterative process for each arc.

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	The value of the cost function is calculated at each iteration and effectively minimised by adjusting the beam transmittance. A high cost results when target dose departs from the desired minimum dose to the target and/or when sensitive structure dose approaches its dose limit. The relative values of the user-defined "target weight" and "structure weights" affect the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be accepted as determined by user and system defined variables." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired prescription and accepting the change of the proposed beam arrangement leads to a	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "The value of the cost function is calculated at each iteration and effectively minimised by adjusting the beam transmittance. A high cost results when target dose departs from the desired minimum dose to the target and/or when sensitive structure dose approaches its dose limit. The relative values of the user-defined "target weight" and "structure weights" affect the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be accepted as determined by user and system defined variables." Carol 1994 Art. 2 at 108.

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greater correspondence to the desired dose prescription to obtain an optimized radiation beam arrangement.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 2. [pre] The method of claim 1 wherein the cost function is obtained by the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 1. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] determining a CDVH associated with the desired dose prescription;	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] assigning zones to each CDVH;	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] assigning weights to each zone, applicable to the CDVHs associated with both the desired dose prescription and	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Optimisation of beam transmittance is performed by applying the simulated annealing algorithm based upon a cost function. Cost is the sum of weighted costs for each structure and target (the weights being specified by the user during prescription). For targets, cost is the mean-squared difference between realised dose and prescribed dose.

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the proposed radiation beam arrangement;	For radiation-sensitive structures, cost is the mean-squared difference between realised dose and zero dose. The algorithm attempts to minimise the cost over the iterative process for each arc. The value of the cost function is calculated at each iteration and effectively minimised by adjusting the beam transmittance. A high cost results when target dose departs from the desired minimum dose to the target and/or when sensitive structure dose approaches its dose limit. The relative values of the user-defined "target weight" and "structure weights" affect the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be accepted as determined by user and system defined variables." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] calculating a zone cost for each target and each structure, according to the following formula: $C_z = W_z * (A_p/A_d)$, where C_z is the cost for the current zone, W_z is the weight	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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assigned to the current zone, A_p is the area or length of the current zone of the proposed CDVH, and where A_d is the area or length of the current zone of the desired CDVH;	
[e] calculating a target or structure cost for each target or structure, according to the following formula: $C_T = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$, and $C_S = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$, where C_S and C_T are the cost for each structure or zone, and C_{z1}, C_{z2}, C_{z3}, and C_{zn}, are the costs calculated for each zone of the first, second, and third,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Optimisation of beam transmittance is performed by applying the simulated annealing algorithm based upon a cost function. Cost is the sum of weighted costs for each structure and target (the weights being specified by the user during prescription). For targets, cost is the mean-squared difference between realised dose and prescribed dose. For radiation-sensitive structures, cost is the mean-squared difference between realised dose and zero dose. The algorithm attempts to minimise the cost over the iterative process for each arc. The value of the cost function is calculated at each iteration and effectively minimised by adjusting the beam transmittance. A high cost results when target dose departs from the desired minimum dose to the target and/or when sensitive structure dose approaches its dose limit. The relative values of the user-defined "target weight" and "structure weights" affect the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be accepted as determined by user and system defined variables." Carol 1994 Art. 2 at 108.

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through the nth zone of each target or structure; and	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[f] calculating a total cost for the change in the proposed radiation beam arrangement, according to the following formula: $C_{Total} = C_S + C_T$, where C_{Total} is the total cost of the proposed change to the radiation beam arrangement.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Optimisation of beam transmittance is performed by applying the simulated annealing algorithm based upon a cost function. Cost is the sum of weighted costs for each structure and target (the weights being specified by the user during prescription). For targets, cost is the mean-squared difference between realised dose and prescribed dose. For radiation-sensitive structures, cost is the mean-squared difference between realised dose and zero dose. The algorithm attempts to minimise the cost over the iterative process for each arc. The value of the cost function is calculated at each iteration and effectively minimised by adjusting the beam transmittance. A high cost results when target dose departs from the desired minimum dose to the target and/or when sensitive structure dose approaches its dose limit. The relative values of the user-defined "target weight" and "structure weights" affect the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be accepted as determined by user and system defined variables." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 5. The method of claim 2,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:*

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wherein the proposed radiation beam arrangement is calculated using simulated annealing radiation therapy planning methods.	"These weightings can be generated through a variety of iterative and algebraic processes. Peacock uses a form of simulated annealing to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but also will keep the dose to other patient volumes below user-defined limits. At each iteration of the simulated annealing process, the weight of a single randomly-chosen beam is changed by a small amount and the resulting effect and 'cost' are calculated. If the resulting cost is lower than the cost from the previous iteration, the change in the beam is accepted. If the resulting cost is higher than the cost from the previous iteration, then the change may not be accepted. After a large number of iterations, a set of beam weights is arrived at which produces the desired result as guided by the restraints placed on the system." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
6. The method of claim 1, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "The Peacock Plan 3-D treatment planning and viewing program is an automatic one: rather than verifying a user-designed program, the system plays an active role in creating the plan." Carol 1994 Art. 2 at 108. "Peacock Plan provides a set of user-friendly tools, operating under the NEXTSTEP operating system running on 80486 and Pentiuma platforms, which allow target volumes and volumes of interest to be identified. The target goal and dose limits for the volumes of interest are defined and constraints are placed on the system (relative importance of delivering the prescribed dose to the complete target versus delivering less than the dose limits to avoidance and sensitive structures, the number of table angles and the thickness of the treatment beam, number of iterations in the annealing process, etc.). After the operator approves the 'prescription,' data is transferred over a local network to a number of Sun Spare IO processors operating in parallel and the autoplan process begins. This process involves 'growing' the targets and structures, constructing a set of beams to be optimised, randomly changing individual beam weights controlled by a cost function to produce a satisfactory set of weights, then normalising the resultant set of beam weights for correct treatment delivery." Carol 1994 Art. 2 at 108.

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	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
7. The method of claim 2, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 6. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
9. The method of claim 5, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 6 and 7. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
10. The method of claim 1, wherein the CDVH associated with the pre-determined desired dose prescription is	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose prescription entered into the computer.	
12. The method of claim 2, wherein the CDVH associated with the pre-determined desired dose prescription is computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 10. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
22. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to a tumor target volume	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 1[pre].

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while minimizing radiation of a structure volume in a patient, comprising the steps of:	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using a computer to computationally obtain a proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 1[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] using a computer to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] incorporating a cost function at each iteration to approach correspondence of partial volume data associated with the proposed radiation beam arrangement to	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 1[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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partial volume data associated with a pre-determined desired does prescription,	
[b2] wherein the proposed radiation beam arrangement is changed by changing the beam weights; and	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "These weightings can be generated through a variety of iterative and algebraic processes. Peacock uses a form of simulated annealing to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but also will keep the dose to other patient volumes below user-defined limits. At each iteration of the simulated annealing process, the weight of a single randomly-chosen beam is changed by a small amount and the resulting effect and 'cost' are calculated. If the resulting cost is lower than the cost from the previous iteration, the change in the beam is accepted. If the resulting cost is higher than the cost from the previous iteration, then the change may not be accepted. After a large number of iterations, a set of beam weights is arrived at which produces the desired result as guided by the restraints placed on the system." Carol 1994 Art. 2 at 108. "Optimisation of beam transmittance is performed by applying the simulated annealing algorithm based upon a cost function. Cost is the sum of weighted costs for each structure and target (the weights being specified by the user during prescription). For targets, cost is the mean-squared difference between realised dose and prescribed dose. For radiation-sensitive structures, cost is the mean-squared difference between realised dose and zero dose. The algorithm attempts to minimise the cost over the iterative process for each arc. The value of the cost function is calculated at each iteration and effectively minimised by adjusting the beam transmittance. A high cost results when target dose departs from the desired minimum dose to the target and/or when sensitive structure dose approaches its dose limit. The relative values of the user-defined "target weight" and "structure weights" affect the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in

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	beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be accepted as determined by user and system defined variables." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired prescription and accepting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a greater correspondence to the desired prescription to obtain an optimized	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 1[d]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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radiation beam arrangement.	
23. The method of claim 22, wherein the partial volume data is entered directly in the computer.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
24. The method of claim 22, wherein the partial volume data is calculated by the computer based on CDVH graphically entered into the computer using a pointing device.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
25. [pre] An apparatus for determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising:	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[pre] and 22[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[a] a computer, adapted to computationally obtain a proposed radiation beam arrangement,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[a] and 22[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] the computer further adapted to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[b] and 22[b1]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b2] wherein the proposed radiation beam arrangement is changed by changing the beam weights,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 22[b2]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] the computer further adapted to incorporate a cost function at each iteration to approach correspondence of	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[c] and 22[c].

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partial volume data associated with the proposed radiation beam arrangement to partial volume data associated with a pre-determined desired dose prescription, and	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] the computer further adapted to reject the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired dose prescription and to accept the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a greater correspondence to the desired does	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[d] and 22[d]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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prescription to obtain an optimized radiation beam arrangement.	
26. The apparatus of claim 25, wherein the partial volume data is represented as a CDVH.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
27. The apparatus of claim 25, further comprising: a conformal radiation therapy apparatus in communication with the computer for applying the optimized radiation beam arrangement to the patient.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 6, 7 and 9. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
28. The apparatus of claim 27, wherein the partial volume data is represented as a CDVH.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 26. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[not asserted] 33. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to at least one tumor target volume while minimizing radiation to at least one structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[pre], 22[pre], and 25[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] distinguishing each of the at least one tumor target volume and each of the at least one structure volume by target or structure type, wherein the target or structure types are distinguished as either Biologically Uniform or Biologically Polymorphic;	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Peacock Plan provides a set of user-friendly tools, operating under the NEXTSTEP operating system running on 80486 and Pentiuma platforms, which allow target volumes and volumes of interest to be identified. The target goal and dose limits for the volumes of interest are defined and constraints are placed on the system (relative importance of delivering the prescribed dose to the complete target versus delivering less than the dose limits to avoidance and sensitive structures, the number of table angles and the thickness of the treatment beam, number of iterations in the annealing process, etc.). After the operator approves the 'prescription,' data is transferred over a local network to a number of Sun Spare IO processors operating in parallel and the autoplan process begins. This process involves 'growing' the targets and structures, constructing a set of beams to be optimised, randomly changing individual beam weights controlled by a cost function to produce a satisfactory set of weights, then normalising the resultant set of beam weights for correct treatment delivery." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[b] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 23. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] entering the desired partial volume data into a computer;	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 23. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] in response to the desired partial volume data and in response to the target or structure type of each of the at least one tumor target volume and each of the at least one structure volume, using the computer to computationally	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "Peacock Plan provides a set of user-friendly tools, operating under the NEXTSTEP operating system running on 80486 and Pentiuma platforms, which allow target volumes and volumes of interest to be identified. The target goal and dose limits for the volumes of interest are defined and constraints are placed on the system (relative importance of delivering the prescribed dose to the complete target versus delivering less than the dose limits to avoidance and sensitive structures, the number of table angles and the thickness of the treatment beam, number of iterations in the annealing process, etc.). After the operator approves the 'prescription,' data is transferred over a local network to a number of Sun Spare IO processors operating in parallel and the autoplan process begins. This process involves 'growing' the targets and structures, constructing a set of beams to be optimised, randomly changing individual beam weights controlled by a cost function to produce a satisfactory set of weights, then normalising the resultant set of beam weights for correct treatment delivery." Carol 1994 Art. 2 at 108.

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calculate an optimized radiation beam arrangement.	To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
34. The method of claim 33, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 6, 7, 9, and 27. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 40. [pre] A method of determining an optimized radiation beam arrangement for applying radiation for at least one tumor target volume while minimizing radiation of at least one structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[pre], 22[pre], 25[pre], 33[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[a] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 33[b]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] entering the desired partial volume data into a computer;	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 23 and 33[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] in response to the desired partial volume data, using the computer to computationally approximate desired CDVHs for each of the at least one target and structure associated with the desired dose prescription; and	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[c], 22[c], and 25[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[d] using the computer to computationally calculate the optimized radiation beam arrangement associated with the CDVHs approximated by the computer.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 1[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
42. The method of claim 40, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 6, 7, 9, 27, and 34. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 44. [pre] The method of claim 40, wherein the CDVHs approximated by the computer are approximated by the steps of:	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claim 40. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using the computer to computationally	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:*

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obtain a set of proposed beam weights;	*See* claims 1[a], 22[a], and 25[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] using the computer to computationally change the set of proposed beam weights iteratively,	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[b], 22[b1], and 25[b1]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b2] incorporating a cost function at each iteration to determine a cost of the change to the set of proposed beam weights; and	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* "These weightings can be generated through a variety of iterative and algebraic processes. Peacock uses a form of simulated annealing to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but also will keep the dose to other patient volumes below user-defined limits. At each iteration of the simulated annealing process, the weight of a single randomly-chosen beam is changed by a small amount and the resulting effect and 'cost' are calculated. If the resulting cost is lower than the cost from the previous iteration, the change in the beam is accepted. If the resulting cost is higher than the cost from the previous iteration, then the change may not be accepted. After a large number of iterations, a set of beam weights is arrived at which produces the desired result as guided by the restraints placed on the system." Carol 1994 Art. 2 at 108. "Optimisation of beam transmittance is performed by applying the simulated annealing algorithm based upon a cost function. Cost is the sum of weighted costs for each structure and target (the weights being specified by the user during prescription). For targets, cost is the mean-squared difference between realised dose and prescribed dose. For radiation-sensitive structures, cost is the mean-squared difference between realised dose and zero dose. The algorithm attempts to minimise the cost over the iterative process for each arc.

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	The value of the cost function is calculated at each iteration and effectively minimised by adjusting the beam transmittance. A high cost results when target dose departs from the desired minimum dose to the target and/or when sensitive structure dose approaches its dose limit. The relative values of the user-defined "target weight" and "structure weights" affect the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be accepted as determined by user and system defined variables." Carol 1994 Art. 2 at 108. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] rejecting the change to the set of proposed beam weights if the change to the set of proposed beam weights leads to a lesser correspondence to the desired CDVHs and accepting the change to the set of proposed beam weights if the change to the set of	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 1[c], 22[c], and 25[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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proposed beam weights leads to a greater correspondence to the desired CDVHs.	
46. The method of claim 44, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1994 Art. 2. For example:* *See* claims 6, 7, 9, 27, 34, and 42. To the extent that this limitation is not fully disclosed or suggested by Carol 1994 Art. 2, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Chart Against U.S. Patent No. 6,038,283 ("'283 patent")

Charted Reference: Mark P. Carol, *Peacock™: A System for Planning and Rotational Delivery of Intensity-Modulated Fields*, 6 Int. J. Imaging Sys. and Tech. 56 (1995) ("**Carol 1995**")

Carol 1995 qualifies as prior art to the '283 patent under at least 35 U.S.C. §§ 102(a) and/or 102(b).[1]

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[not asserted] 1. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Carol 1995. For example:* "This hypothesis is the basis for conformal therapy-delivering a high dose of radiation in a spatial distribution conforming to the shape of the target volume while concomitantly decreasing the volume of the surrounding normal tissue receiving that same dose [9]." Carol 1995 at 56. "Unlike typical experience-based, trial-and-error approaches to treatment planning, Peacock Plan starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution [8]. Peacock uses a so-called fast simulated annealing process to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but will also keep the dose to avoidance volumes (volumes which should receive no radiation) and sensitive volumes (volumes which have a dose limit which is less than the dose to the target volume) below user-defined limits." Carol 1995 at 57. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

[1] The excerpts cited herein are exemplary. For any claim limitation, Defendant may rely on excerpts cited for any other limitation and/or additional excerpts not set forth fully herein to the extent necessary to provide a more comprehensive explanation for a reference's disclosure of a limitation. Where an excerpt refers to or discusses a figure or figure items, that figure and any additional descriptions of that figure should be understood to be incorporated by reference as if set forth fully therein.

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Claim Element	**Evidence of Invalidity**
[a] using a computer to computationally obtain a proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Carol 1995. For example:* "The parameters driving beam modulation and field shaping are generated by a three-dimensional planning computer using a simulated annealing algorithm guided by cost functions which quantify prescribed treatment constraints." Carol 1995 at 56. "Unlike typical experience-based, trial-and-error approaches to treatment planning, Peacock Plan starts with the desired dose distribution and works in reverse to generate the beam weights needed to produce this distribution [8]. Peacock uses a so-called fast simulated annealing process to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but will also keep the dose to avoidance volumes (volumes which should receive no radiation) and sensitive volumes (volumes which have a dose limit which is less than the dose to the target volume) below user-defined limits." Carol 1995 at 57. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] using a computer to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1995. For example:* "Peacock uses a so-called fast simulated annealing process to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but will also keep the dose to avoidance volumes (volumes which should receive no radiation) and sensitive volumes (volumes which have a dose limit which is less than the dose to the target volume) below user-defined limits [5, 12, 14-17]. The iterative planning process for changing beam weights is driven by a cost function—the higher the cost associated with a particular change in beam weights, the less likely the system is to retain the change." Carol 1995 at 57. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[c] incorporating a cost function at each iteration to approach correspondence of a CDVH associated with the proposed radiation beam arrangement to a CDVH associated with a predetermined desired dose prescription; and	*This limitation is disclosed or suggested by Carol 1995. For example:* "The iterative planning process for changing beam weights is driven by a cost function—the higher the cost associated with a particular change in beam weights, the less likely the system is to retain the change. Peacock defines cost as the sum of weighted costs for each structure and target (weights as specified during "Prescription"). For targets, cost is the mean-squared difference between realized dose and prescribed dose. For structures, cost is the mean-squared difference between realized dose and zero dose. Cost = Sum[CostI] + Sum[CostJ] , where for: I = 1, N_Targets, J = 1, N_Structures CostI is the cost for target I: CostI = Weight⟨(DoseI − MinDoseI)^2⟩ / $Dose_{min}$I^2 CostJ is the cost for structure J: CostJ = WeightJ⟨DoseJ^2⟩ / $Dose_{limit}$J^2 The brackets (<>) denote an average over all voxels in target I or sensitive structure J. The algorithm attempts to minimize the cost at any iteration." Carol 1995 at 57-58. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser	*This limitation is disclosed or suggested by Carol 1995. For example:* "The parameters driving beam modulation and field shaping are generated by a three-dimensional planning computer using a simulated annealing algorithm guided by cost functions which quantify prescribed treatment constraints." Carol 1995 at 56. "The value of the cost function is calculated at each iteration and is minimized by adjusting the beam transmittance. The relative values of "WeightI" (target weight) and "WeightJ" (structure weights) emphasize or

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correspondence to the desired prescription and accepting the change of the proposed beam arrangement leads to a greater correspondence to the desired dose prescription to obtain an optimized radiation beam arrangement.	deemphasize the contribution of each target and structure to the total cost. To save computation time during the iterative process, an approximate dose is calculated by updating the dose volume only for the beam which has been changed and only for the parts of that beam which contribute dose over a threshold amount. If the resulting cost is lower than the cost obtained from the previous iteration, the change in beam transmittance is accepted. If the resulting cost is higher than the cost from the previous iteration, the change in beam weightings may still be rejected as determined by: $P(\text{acceptance}) = \text{Exp}(-\text{Cost}/kTn)$, where with N = number of beams being optimized; kTn is the "temperature" at iteration n: kTn = (initial kT per beam) N/n " Carol 1995 at 58. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 2. [pre] The method of claim 1 wherein the cost function is obtained by the steps of:	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 1. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] determining a CDVH associated with the desired dose prescription;	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[b] assigning zones to each CDVH;	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] assigning weights to each zone, applicable to the CDVHs associated with both the desired dose prescription and the proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Carol 1995. For example:* "Peacock defines cost as the sum of weighted costs for each structure and target (weights as specified during "Prescription"). For targets, cost is the mean-squared difference between realized dose and prescribed dose. For structures, cost is the mean-squared difference between realized dose and zero dose. Cost = Sum[CostI] + Sum[CostJ] , where for: I = 1, N_Targets, J = 1, N_Structures CostI is the cost for target I: CostI = Weight⟨(DoseI − MinDoseI)^2⟩ / $Dose_{min}$I^2 CostJ is the cost for structure J: CostJ = WeightJ⟨DoseJ^2⟩ / $Dose_{limit}$J^2 The brackets (<>) denote an average over all voxels in target I or sensitive structure J. The algorithm attempts to minimize the cost at any iteration. The value of the cost function is calculated at each iteration and is minimized by adjusting the beam transmittance. The relative values of "WeightI" (target weight) and "WeightJ" (structure weights) emphasize or deemphasize the contribution of each target and structure to the total cost." Carol 1995 at 57-58. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] calculating a zone cost for each target and each structure,	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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according to the following formula: $C_z = W_z * (A_p/A_d)$, where C_z is the cost for the current zone, W_z is the weight assigned to the current zone, A_p is the area or length of the current zone of the proposed CDVH, and where A_d is the area or length of the current zone of the desired CDVH;	
[e] calculating a target or structure cost for each target or structure, according to the following formula: $C_T = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$, and $C_S = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$,	*This limitation is disclosed or suggested by Carol 1995. For example:* "Peacock defines cost as the sum of weighted costs for each structure and target (weights as specified during "Prescription"). For targets, cost is the mean-squared difference between realized dose and prescribed dose. For structures, cost is the mean-squared difference between realized dose and zero dose. Cost = Sum[CostI] + Sum[CostJ] , where for: I = 1, N_Targets, J = 1, N_Structures CostI is the cost for target I: CostI = Weight⟨(DoseI − MinDoseI)^2⟩ / $Dose_{min}$I^2 CostJ is the cost for structure J: CostJ = WeightJ⟨DoseJ^2⟩ / $Dose_{limit}$J^2

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where C_S and C_T are the cost for each structure or zone, and C_{z1}, C_{z2}, C_{z3}, and C_{zn}, are the costs calculated for each zone of the first, second, and third, through the nth zone of each target or structure; and	The brackets (<>) denote an average over all voxels in target I or sensitive structure J. The algorithm attempts to minimize the cost at any iteration." Carol 1995 at 57. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[f] calculating a total cost for the change in the proposed radiation beam arrangement, according to the following formula: $C_{Total} = C_S + C_T$, where C_{Total} is the total cost of the proposed change to the radiation beam arrangement.	*This limitation is disclosed or suggested by Carol 1995. For example:* "Peacock defines cost as the sum of weighted costs for each structure and target (weights as specified during "Prescription"). For targets, cost is the mean-squared difference between realized dose and prescribed dose. For structures, cost is the mean-squared difference between realized dose and zero dose. Cost = Sum[CostI] + Sum[CostJ] , where for: I = 1, N_Targets, J = 1, N_Structures CostI is the cost for target I: CostI = Weight⟨(Dosel − MinDosel)^2⟩ / $Dose_{min}$I^2 CostJ is the cost for structure J: CostJ = WeightJ⟨DoseJ^2⟩ / $Dose_{limit}$J^2 The brackets (<>) denote an average over all voxels in target I or sensitive structure J. The algorithm attempts to minimize the cost at any iteration." Carol 1995 at 57.

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	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 5. The method of claim 2, wherein the proposed radiation beam arrangement is calculated using simulated annealing radiation therapy planning methods.	*This limitation is disclosed or suggested by Carol 1995. For example:* "The parameters driving beam modulation and field shaping are generated by a three-dimensional planning computer using a simulated annealing algorithm guided by cost functions which quantify prescribed treatment constraints." Carol 1995 at 56. "Peacock uses a so-called fast simulated annealing process to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but will also keep the dose to avoidance volumes (volumes which should receive no radiation) and sensitive volumes (volumes which have a dose limit which is less than the dose to the target volume) below user-defined limits [5, 12, 14-17]. The iterative planning process for changing beam weights is driven by a cost function—the higher the cost associated with a particular change in beam weights, the less likely the system is to retain the change." Carol 1995 at 57. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
6. The method of claim 1, further comprising the step of applying the optimized radiation beam arrangement to the patient with a	*This limitation is disclosed or suggested by Carol 1995. For example:* "The Peacock three-Dimensional Conformal System plans for and implements, through the use of a multileaf intensity modulating collimator (MIMiC)… The MIMiC is an electropneumatic implementation device which slides into the wedge/blocking/accessory tray slot on the treatment machine." Carol 1995 at 56.

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conformal radiation therapy apparatus.	"Patients treatments with Peacock began in March 1994 under IDEs; eight patients had been treated as of September 1994." Carol 1995 at 61. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
7. The method of claim 2, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 6. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
9. The method of claim 5, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 6 and 7. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
10. The method of claim 1, wherein the CDVH associated	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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with the pre-determined desired dose prescription is computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose prescription entered into the computer.	
12. The method of claim 2, wherein the CDVH associated with the pre-determined desired dose prescription is computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 10. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
22. [pre] A method of determining an optimized radiation	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 1[pre].

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beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising the steps of:	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using a computer to computationally obtain a proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 1[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] using a computer to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] incorporating a cost function at each iteration to approach correspondence of partial volume data	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 1[c].

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associated with the proposed radiation beam arrangement to partial volume data associated with a pre-determined desired does prescription,	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b2] wherein the proposed radiation beam arrangement is changed by changing the beam weights; and	*This limitation is disclosed or suggested by Carol 1995. For example:* "Peacock uses a so-called fast simulated annealing process to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but will also keep the dose to avoidance volumes (volumes which should receive no radiation) and sensitive volumes (volumes which have a dose limit which is less than the dose to the target volume) below user-defined limits [5, 12, 14-17]." Carol 1995 at 57. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired prescription and accepting the	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 1[d]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a greater correspondence to the desired prescription to obtain an optimized radiation beam arrangement.	
23. The method of claim 22, wherein the partial volume data is entered directly in the computer.	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
24. The method of claim 22, wherein the partial volume data is calculated by the computer based on CDVH graphically entered into the computer using a pointing device.	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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25. [pre] An apparatus for determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising:	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[pre] and 22[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] a computer, adapted to computationally obtain a proposed radiation beam arrangement,	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[a] and 22[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] the computer further adapted to computationally change the proposed radiation beam arrangement iteratively,	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[b] and 22[b1]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b2] wherein the proposed radiation beam arrangement is	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 22[b2].

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changed by changing the beam weights,	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] the computer further adapted to incorporate a cost function at each iteration to approach correspondence of partial volume data associated with the proposed radiation beam arrangement to partial volume data associated with a pre-determined desired dose prescription, and	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[c] and 22[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] the computer further adapted to reject the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[d] and 22[d]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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desired dose prescription and to accept the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a greater correspondence to the desired does prescription to obtain an optimized radiation beam arrangement.	
26. The apparatus of claim 25, wherein the partial volume data is represented as a CDVH.	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
27. The apparatus of claim 25, further comprising: a conformal radiation therapy apparatus in communication with the computer for applying the optimized radiation	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 6, 7 and 9. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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beam arrangement to the patient.	
28. The apparatus of claim 27, wherein the partial volume data is represented as a CDVH.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 26. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 33. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to at least one tumor target volume while minimizing radiation to at least one structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[pre], 22[pre], and 25[pre]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] distinguishing each of the at least one tumor target volume and each of the at least one	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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structure volume by target or structure type, wherein the target or structure types are distinguished as either Biologically Uniform or Biologically Polymorphic;	
[b] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 23. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] entering the desired partial volume data into a computer;	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 23. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] in response to the desired partial volume data and in response	*This limitation is disclosed or suggested by Carol 1995. For example:*

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to the target or structure type of each of the at least one tumor target volume and each of the at least one structure volume, using the computer to computationally calculate an optimized radiation beam arrangement.	"The Peacock three-Dimensional Conformal System plans for and implements, through the use of a multileaf intensity modulating collimator (MIMiC)… The MIMiC is an electropneumatic implementation device which slides into the wedge/blocking/accessory tray slot on the treatment machine." Carol 1995 at 56. "Peacock uses a so-called fast simulated annealing process to determine a set of beam weights which will deliver not only the prescribed dose to the identified target volume but will also keep the dose to avoidance volumes (volumes which should receive no radiation) and sensitive volumes (volumes which have a dose limit which is less than the dose to the target volume) below user-defined limits [5, 12, 14-17]." Carol 1995 at 57. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
34. The method of claim 33, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 6, 7, 9, and 27. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 40. [pre] A method of determining an optimized radiation beam arrangement for applying radiation for	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[pre], 22[pre], 25[pre], 33[pre].

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at least one tumor target volume while minimizing radiation of at least one structure volume in a patient, comprising the steps of:	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 33[b]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] entering the desired partial volume data into a computer;	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 23 and 33[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] in response to the desired partial volume data, using the computer to computationally	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[c], 22[c], and 25[c].

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approximate desired CDVHs for each of the at least one target and structure associated with the desired dose prescription; and	To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] using the computer to computationally calculate the optimized radiation beam arrangement associated with the CDVHs approximated by the computer.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claim 1[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
42. The method of claim 40, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 6, 7, 9, 27, and 34. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 44. [pre] The method of	*This limitation is disclosed or suggested by Carol 1995. For example:*

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Claim Element	**Evidence of Invalidity**
claim 40, wherein the CDVHs approximated by the computer are approximated by the steps of:	*See* claim 40. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using the computer to computationally obtain a set of proposed beam weights;	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[a], 22[a], and 25[a]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b1] using the computer to computationally change the set of proposed beam weights iteratively,	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[b], 22[b1], and 25[b1]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b2] incorporating a cost function at each iteration to determine a cost of the change to the set of proposed beam weights; and	*This limitation is disclosed or suggested by Carol 1995. For example:* "The iterative planning process for changing beam weights is driven by a cost function—the higher the cost associated with a particular change in beam weights, the less likely the system is to retain the change. Peacock defines cost as the sum of weighted costs for each structure and target (weights as specified during "Prescription"). For targets, cost is the mean-squared difference between realized dose and prescribed dose. For structures, cost is the mean-squared difference between realized dose and zero dose.

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Claim Element	**Evidence of Invalidity**
	Cost = Sum[CostI] + Sum[CostJ] , where for: I = 1, N_Targets, J = 1, N_Structures CostI is the cost for target I: $CostI = Weight\langle(Dosel - MinDosel)\hat{}2\rangle / Dose_{min}I\hat{}2$ CostJ is the cost for structure J: $CostJ = WeightJ\langle DoseJ\hat{}2\rangle / Dose_{limit}J\hat{}2$ The brackets (<>) denote an average over all voxels in target I or sensitive structure J. The algorithm attempts to minimize the cost at any iteration." Carol 1995 at 57-58. "The value of the cost function is calculated at each iteration and is minimized by adjusting the beam transmittance. The relative values of "WeightI" (target weight) and "WeightJ" (structure weights) emphasize or deemphasize the contribution of each target and structure to the total cost." Carol 1995 at 58. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] rejecting the change to the set of proposed beam weights if the change to the set of proposed beam weights leads to a lesser correspondence to the desired CDVHs and accepting the change to the set of proposed	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 1[c], 22[c], and 25[c]. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Element	**Evidence of Invalidity**
beam weights if the change to the set of proposed beam weights leads to a greater correspondence to the desired CDVHs.	
46. The method of claim 44, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Carol 1995. For example:* *See* claims 6, 7, 9, 27, 34, and 42. To the extent that this limitation is not fully disclosed or suggested by Carol 1995, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Chart Against U.S. Patent No. 6,038,283 ("'283 patent")

Charted Reference: Per Hahn, et al., *Treatment Planning for Protocol-Based Radiation Therapy*, 18 Int. J. Radiation Oncology Biol. Phys. 937 (1990) ("**Hahn**")

Hahn, published in 1990, qualifies as prior art to the '283 patent under at least 35 U.S.C. §§ 102(a) and/or 102(b).[1]

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Claim Element	**Evidence of Invalidity**
[not asserted] 1. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Hahn. For example:* "We have investigated the use of dose-area histograms to ensure complete adherence to protocol dose specifications. A dose prescription is prepared that defines upper and lower target doses as well as normal tissue dose tolerance levels for all organs of interest. In addition, dose-volume histograms are derived which provide quantitative measures of the extent to which each dose limit has been met. This technique can be used during treatment planning to prevent protocol violations of pre-defined severity, or for retroactive correlation of local tumor recurrence and treatment-related morbidity with dose levels in the target and normal tissues." Hahn. Abstract, at 937. "Conversely, we would like to have a planning technique which would ensure that the dose distribution, both within and outside the target, is evaluated in an objective manner for each plan and maintained within prescribed limits." Hahn at 937. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

[1] The excerpts cited herein are exemplary. For any claim limitation, Defendant may rely on excerpts cited for any other limitation and/or additional excerpts not set forth fully herein to the extent necessary to provide a more comprehensive explanation for a reference's disclosure of a limitation. Where an excerpt refers to or discusses a figure or figure items, that figure and any additional descriptions of that figure should be understood to be incorporated by reference as if set forth fully therein.

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Claim Element	**Evidence of Invalidity**
[a] using a computer to computationally obtain a proposed radiation beam arrangement;	*This limitation is disclosed or suggested by Hahn. For example:* "Clearly a full 3-dimensional computation would be more satisfactory, if the resources were available." Hahn at 939. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] using a computer to computationally change the proposed radiation beam arrangement iteratively, incorporating a cost function at each iteration to approach correspondence of a CDVH associated with the proposed radiation beam arrangement to a CDVH associated with a predetermined desired dose prescription; and	*This limitation is disclosed or suggested by Hahn. For example:* "We have investigated the use of dose-area histograms to ensure complete adherence to protocol dose specifications. A dose prescription is prepared that defines upper and lower target doses as well as normal tissue dose tolerance levels for all organs of interest. In addition, dose-volume histograms are derived which provide quantitative measures of the extent to which each dose limit has been met. This technique can be used during treatment planning to prevent protocol violations of pre-defined severity, or for retroactive correlation of local tumor recurrence and treatment-related morbidity with dose levels in the target and normal tissues." Hahn. Abstract, at 937. "Conversely, we would like to have a planning technique which would ensure that the dose distribution, both within and outside the target, is evaluated in an objective manner for each plan and maintained within prescribed limits." Hahn at 937.

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U.S. Patent No. 6,038,283	
Claim Element	**Evidence of Invalidity**
	To achieve the objectives set out above, we suggest the use of a dose prescription as shown in Table 1. For the target the dose prescription defines two overdose limits and two underdose limits, together with maximum volumes, expressed as percentages of the target volume, which

Table 1. Dose prescription for ca prostate

Type of regret		Dose (Gy)	Tolerance area (%)
Target overdose	(severe)	73	20
	(mild)	69	50
Target underdose	(severe)	59	5
	(mild)	63	50
Normal tissue	(severe)	59	50
	(mild)	53	100
Rectum		55	80
Femoral heads		58	10
Bladder		60	10

may be outside these dose limits. For non-target tissue a similar pair of dose-volume limits is specified, with the volume again expressed as a percentage of the target volume. For specific sensitive organs a single dose-volume limit is specified, with the volume expressed as a percentage of the volume of the corresponding organ. The application of this type of dose prescription in radiotherapy planning has been discussed in detail elsewhere (4–9).

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U.S. Patent No. 6,038,283	
Claim Element	**Evidence of Invalidity**
	Cumulative dose-volume histograms (CDVH's) have been advocated by several authors as a means of assessing treatment plans (1–3). They provide a simple and effective method of verifying the compliance of a proposed plan with the dose prescription, since each dose-volume limit can be represented as a point on the cumulative dose-volume plot. This is illustrated in Figure 1, where the target dose-volume limits from Table 1 are shown as triangles, pointing up for underdose limits and down for overdose limits. A plan which meets the prescription requirements will have a CDVH which passes above the underdose points and below the overdose points, as is the case for all the histograms shown in Figure 1. Hahn at 937-38.

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	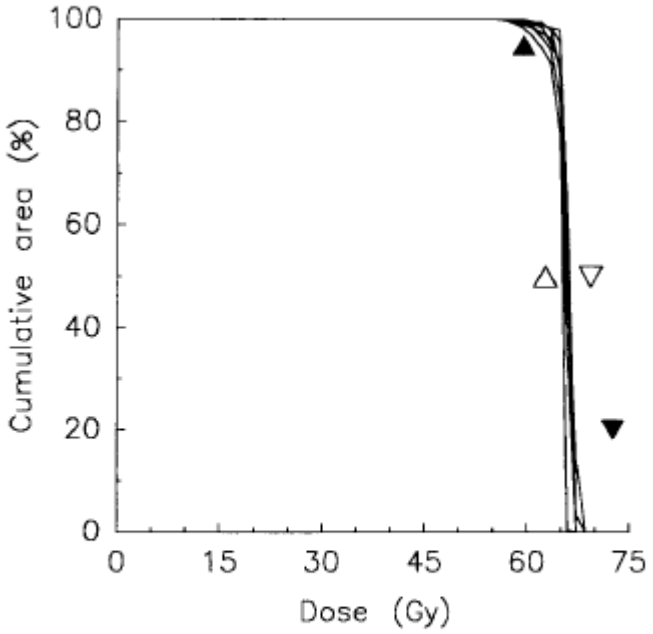 Fig. 1. Cumulative dose area histograms for mid-plane target regions in seven patients with adenocarcinoma of the prostate. Inverted triangles represent tolerance points for target overdose, and upright triangles are tolerance points for target underdose. Open symbols are mild, and closed symbols are severe tolerances. Hahn at 938. "We propose that a dose prescription be prepared as part of a protocol description, and that dose limits be defined for the target and sensitive organs at risk. CDVH's can then be plotted and the curves evaluated in terms of tolerance points derived from the dose prescription." Hahn at 939.

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Claim Element	**Evidence of Invalidity**
	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired prescription and accepting the change of the proposed beam arrangement leads to a greater correspondence to the desired dose prescription to obtain an optimized radiation beam arrangement.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 2. [pre] The method of claim 1 wherein the cost function is obtained by the steps of:	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] determining a CDVH associated with the desired dose prescription;	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b].

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	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] assigning zones to each CDVH;	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] assigning weights to each zone, applicable to the CDVHs associated with both the desired dose prescription and the proposed radiation beam arrangement;	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] calculating a zone cost for each target and each structure, according to the following formula: $C_z = W_z * (A_p/A_d)$, where C_z is the cost for the current zone, W_z is the weight assigned to the current zone, A_p is the area or length of the current zone of the proposed CDVH, and where A_d is the	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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area or length of the current zone of the desired CDVH;	
[e] calculating a target or structure cost for each target or structure, according to the following formula: $C_T = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$, and $C_S = \Sigma C_{z1} + C_{z2} + C_{z3} + \ldots C_{zn}$, where C_S and C_T are the cost for each structure or zone, and C_{z1}, C_{z2}, C_{z3}, and C_{zn}, are the costs calculated for each zone of the first, second, and third, through the nth zone of each target or structure; and	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[f] calculating a total cost for the change in the proposed radiation beam arrangement, according to the following formula: $C_{Total} = C_S + C_T$,	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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where C_{Total} is the total cost of the proposed change to the radiation beam arrangement.	
[not asserted] 5. The method of claim 2, wherein the proposed radiation beam arrangement is calculated using simulated annealing radiation therapy planning methods.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
6. The method of claim 1, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Hahn. For example:* "We have shown that uniformity of treatment during a protocol study may not be assured by specifying only dose limits for the target. It is also necessary to prescribe dose limits on all sensitive organs, and to verify that each patient is treated within these limits. In this example, seven patients were treated for ca prostate with nominally equal dose distributions, as specified by the protocol parameters." Hahn at 939. *See also* claims 7, 9. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
7. The method of claim 2, further comprising the step of applying the optimized radiation beam arrangement to the patient with a	*This limitation is disclosed or suggested by Hahn. For example:* "We have investigated the use of dose-area histograms to ensure complete adherence to protocol dose specifications. A dose prescription is prepared that defines upper and lower target doses as well as normal tissue dose tolerance levels for all organs of interest. In addition, dose-volume histograms are derived which

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conformal radiation therapy apparatus.	provide quantitative measures of the extent to which each dose limit has been met. This technique can be used during treatment planning to prevent protocol violations of pre-defined severity, or for retroactive correlation of local tumor recurrence and treatment-related morbidity with dose levels in the target and normal tissues." Hahn. Abstract, at 937. *See also* claims 6, 9. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
9. The method of claim 5, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Hahn. For example:* "We have investigated the use of dose-area histograms to ensure complete adherence to protocol dose specifications. A dose prescription is prepared that defines upper and lower target doses as well as normal tissue dose tolerance levels for all organs of interest. In addition, dose-volume histograms are derived which provide quantitative measures of the extent to which each dose limit has been met. This technique can be used during treatment planning to prevent protocol violations of pre-defined severity, or for retroactive correlation of local tumor recurrence and treatment-related morbidity with dose levels in the target and normal tissues." Hahn. Abstract, at 937. *See also* claims 6, 7. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
10. The method of claim 1, wherein the CDVH associated with the pre-determined	*This limitation is disclosed or suggested by Hahn. For example:*

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desired dose prescription is computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose prescription entered into the computer.	To achieve the objectives set out above, we suggest the use of a dose prescription as shown in Table 1. For the target the dose prescription defines two overdose limits and two underdose limits, together with maximum volumes, expressed as percentages of the target volume, which

Table 1. Dose prescription for ca prostate

Type of regret		Dose (Gy)	Tolerance area (%)
Target overdose	(severe)	73	20
	(mild)	69	50
Target underdose	(severe)	59	5
	(mild)	63	50
Normal tissue	(severe)	59	50
	(mild)	53	100
Rectum		55	80
Femoral heads		58	10
Bladder		60	10

may be outside these dose limits. For non-target tissue a similar pair of dose-volume limits is specified, with the volume again expressed as a percentage of the target volume. For specific sensitive organs a single dose-volume limit is specified, with the volume expressed as a percentage of the volume of the corresponding organ. The application of this type of dose prescription in radiotherapy planning has been discussed in detail elsewhere (4–9).

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U.S. Patent No. 6,038,283	
Claim Element	**Evidence of Invalidity**
	Cumulative dose-volume histograms (CDVH's) have been advocated by several authors as a means of assessing treatment plans (1–3). They provide a simple and effective method of verifying the compliance of a proposed plan with the dose prescription, since each dose-volume limit can be represented as a point on the cumulative dose-volume plot. This is illustrated in Figure 1, where the target dose-volume limits from Table 1 are shown as triangles, pointing up for underdose limits and down for overdose limits. A plan which meets the prescription requirements will have a CDVH which passes above the underdose points and below the overdose points, as is the case for all the histograms shown in Figure 1. Hahn at 937-38.

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	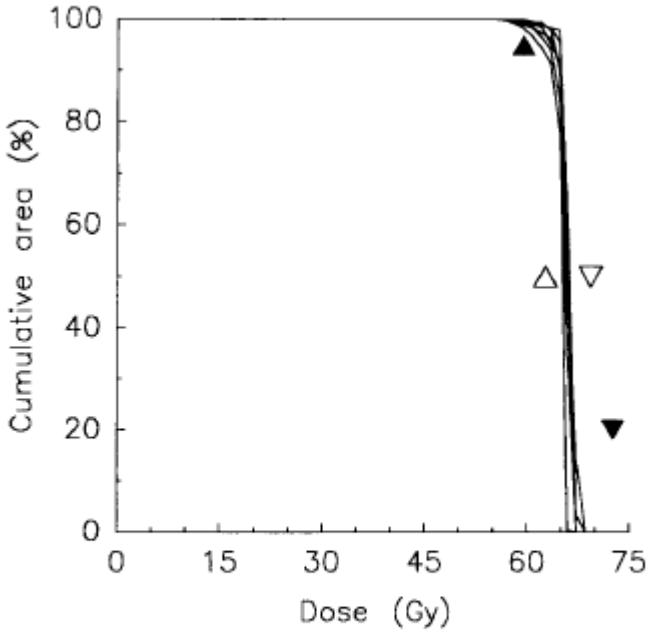 Fig. 1. Cumulative dose area histograms for mid-plane target regions in seven patients with adenocarcinoma of the prostate. Inverted triangles represent tolerance points for target overdose, and upright triangles are tolerance points for target underdose. Open symbols are mild, and closed symbols are severe tolerances. Hahn at 938. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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12. The method of claim 2, wherein the CDVH associated with the pre-determined desired dose prescription is computationally constructed by the computer based on partial volume data associated with the pre-determined desired dose.	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 10. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
22. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[pre]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using a computer to computationally obtain a proposed radiation beam arrangement;	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] using a computer to computationally change the proposed radiation beam arrangement iteratively, incorporating a cost function at each iteration to approach	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b].

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Claim Element	**Evidence of Invalidity**
correspondence of partial volume data associated with the proposed radiation beam arrangement to partial volume data associated with a pre-determined desired does prescription, wherein the proposed radiation beam arrangement is changed by changing the beam weights; and	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] rejecting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired prescription and accepting the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a greater correspondence to the desired prescription to obtain an optimized radiation beam arrangement.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Element	**Evidence of Invalidity**
23. The method of claim 22, wherein the partial volume data is entered directly in the computer.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
24. The method of claim 22, wherein the partial volume data is calculated by the computer based on CDVH graphically entered into the computer using a pointing device.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
25. [pre] An apparatus for determining an optimized radiation beam arrangement for applying radiation to a tumor target volume while minimizing radiation of a structure volume in a patient, comprising:	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[pre], 22[pre]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] a computer, adapted to computationally obtain a proposed radiation beam arrangement,	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] the computer further adapted to computationally change the proposed radiation	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Element	**Evidence of Invalidity**
beam arrangement iteratively, wherein the proposed radiation beam arrangement is changed by changing the beam weights,	
[d] the computer further adapted to incorporate a cost function at each iteration to approach correspondence of partial volume data associated with the proposed radiation beam arrangement to partial volume data associated with a pre-determined desired dose prescription, and	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[e] the computer further adapted to reject the change of the proposed radiation beam arrangement if the change of the proposed radiation beam arrangement leads to a lesser correspondence to the desired dose prescription and to accept the change of the proposed radiation beam arrangement if the change of the proposed radiation beam	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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U.S. Patent No. 6,038,283	
Claim Element	**Evidence of Invalidity**
arrangement leads to a greater correspondence to the desired does prescription to obtain an optimized radiation beam arrangement.	
26. The apparatus of claim 25, wherein the partial volume data is represented as a CDVH.	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
27. The apparatus of claim 25, further comprising: a conformal radiation therapy apparatus in communication with the computer for applying the optimized radiation beam arrangement to the patient.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
28. The apparatus of claim 27, wherein the partial volume data is represented as a CDVH.	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 26. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Element	**Evidence of Invalidity**
[not asserted] 33. [pre] A method of determining an optimized radiation beam arrangement for applying radiation to at least one tumor target volume while minimizing radiation to at least one structure volume in a patient, comprising the steps of:	*This limitation is disclosed or suggested by Hahn. For example:* *See* claims 1[pre], 22[pre], 25[pre]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] distinguishing each of the at least one tumor target volume and each of the at least one structure volume by target or structure type, wherein the target or structure types are distinguished as either Biologically Uniform or Biologically Polymorphic;	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[c] entering the desired partial volume data into a computer;	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] in response to the desired partial volume data and in response to the target or structure type of each of the at least one tumor target volume and each of the at least one structure volume, using the computer to computationally calculate an optimized radiation beam arrangement.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
34. The method of claim 33, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 40. [pre] A method of determining an optimized radiation beam arrangement for applying radiation for at least one tumor target volume while minimizing radiation of at	*This limitation is disclosed or suggested by Hahn. For example:* *See* claims 1[pre], 22[pre], 25[pre], 33[pre]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Element	**Evidence of Invalidity**
least one structure volume in a patient, comprising the steps of:	
[a] determining desired partial volume data for each of the at least one target volume and structure volume associated with a desired dose prescription;	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] entering the desired partial volume data into a computer;	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[c] in response to the desired partial volume data, using the computer to computationally approximate desired CDVHs for each of the at least one target and structure associated with the desired dose prescription; and	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 1[b]. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[d] using the computer to computationally calculate the optimized radiation beam arrangement associated with	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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Claim Element	**Evidence of Invalidity**
the CDVHs approximated by the computer.	
42. The method of claim 40, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 7. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[not asserted] 44. [pre] The method of claim 40, wherein the CDVHs approximated by the computer are approximated by the steps of:	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[a] using the computer to computationally obtain a set of proposed beam weights;	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
[b] using the computer to computationally change the set of proposed beam weights iteratively, incorporating a cost function at each iteration to determine a cost of the change to the set of proposed beam weights; and	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.

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[c] rejecting the change to the set of proposed beam weights if the change to the set of proposed beam weights leads to a lesser correspondence to the desired CDVHs and accepting the change to the set of proposed beam weights if the change to the set of proposed beam weights leads to a greater correspondence to the desired CDVHs.	To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.
46. The method of claim 44, further comprising the step of applying the optimized radiation beam arrangement to the patient with a conformal radiation therapy apparatus.	*This limitation is disclosed or suggested by Hahn. For example:* *See* claim 7. To the extent that this limitation is not fully disclosed or suggested by Hahn, this limitation would have been obvious to a person of ordinary skill in the art in combination with the general knowledge in the field and/or with any of the references identified in Appendix A of the Invalidity Contentions.